

mental tobacco smoke, but some more recent studies have considered such exposure at work and have found that the workplace may be a significant source of exposure. For example, a study based on data from the Los Angeles County Tumor Registry found that workplace exposure to environmental tobacco smoke additionally increased the lung cancer risk observed from spousal smoking alone. This finding is not surprising, as some estimates are that exposure to environmental tobacco smoke in the workplace may, on an average, be four times that at home. In general, such exposures have been poorly estimated for the workplace, and further work is necessary in quantifying this important source of exposure.

In the 1980s we have seen increasing regulation of smoking in the workplace. Smoking has been banned in 35% to 40% of private businesses and in many government offices.

Interestingly, actions to ban or regulate smoking in the workplace are supported by a large majority of both smokers and nonsmokers. As the trend to cleaner air at work continues, physicians (and companies) may see more reductions in smoking rates, with associated decreases in the health costs from active and passive smoking.

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Agricultural Health Hazards

EDITOR'S NOTE: The following mini-review is also sponsored by the Advisory Panel to the Section on Occupational Medicine.

AGRICULTURAL WORK is demanding. Because the work is done outdoors and is invigorating, physicians may be unaware that agriculture has many health risks. The following occupations are included in this industrial group: farmers and farm managers; field workers or farmworkers (seasonal or permanent); pesticide mixers, loaders, and applicators; and greenhouse/nursery workers. In this review I will focus on the agricultural exposures that are linked with respiratory disease (farmer's lung), cancer of different sites, dermatitis, and accidental mortality.

Patients with farmer's lung present with allergic alveolitis usually after exposure to moldy hay or grain. The hay contains thermophilic microorganisms such as *Micropolyspora faeni* and *Thermoactinomyces vulgaris*. Inhaling the spores usually produces an acute bronchoconstriction that may include bilateral crackles, a positive antibody test for the suspected antigen, and reduced lung volumes and diffusing capacity. Prolonged exposure can produce a slowly progressive pulmonary fibrosis. Allergic alveolitis may also arise among agricultural workers involved with mushroom cultivation, barley malt production, cheese making, poultry handling and breeding, and fur processing. The Surgeon General reports that nonsmoking grain workers have about five times the prevalence of chronic bronchitis compared with nonsmoking con-

trols; among grain workers who smoke, there is ten times the risk of bronchitis compared with nonsmoking controls.

Farmers and farmworkers smoke a third to a quarter less than all workers in the United States and generally have lower than expected risks for cardiovascular and cancer mortality. In particular, cancer sites related to cigarette smoking—that is, lung, kidney and bladder, and esophagus and larynx—show a consistently lower risk when compared with the general population. There appears, however, to be an association between farming occupations and cancers of the brain, prostate gland, skin, soft tissues, and the lymphatic and hematopoietic systems, including leukemia, Hodgkin's disease, lymphoma, and multiple myeloma. Explanations for the causes of brain and prostate cancer excesses are unclear. Nonmelanoma skin cancers, including cancer of the lip, are caused by a high exposure to ultraviolet light. The lymphatic cancers (and soft tissue sarcomas) among agricultural workers may be linked to exposure to chlorophenols and phenoxyacetic acid herbicides (that were contaminated with detectable levels of dioxin). In particular, in a 1986 study, non-Hodgkin's lymphoma (but not soft tissue sarcomas or Hodgkin's disease) had a sixfold odds ratio among Kansas wheat farmers exposed to 2,4-dichlorophenoxyacetic acid (2,4-D). The risk rose with the number of days exposed per year and was greater among those who mixed or applied herbicides directly. Pesticide applicators appear to have a slight lung cancer risk, but more studies are needed on this group of workers, especially those who have applied 2,4-D extensively.

Occupational dermatitis is highly correlated with the agricultural use of pesticides among farmworkers and among licensed mixers, loaders, and applicators. In California, a third to half of all cases of pesticide poisonings reported by physicians result in dermatoses, and there is a striking frequency of dermatitis among table grape workers compared with other agricultural crops. This result is not surprising given the high foliar contact and careful handling required in the harvesting of table grapes. The top three pesticides cited in California pesticide illness reports are propargite (Omite), elemental sulfur, and glyphosate (Roundup). There was a recent outbreak of chemical dermatitis affecting the necks and chests of 114 citrus workers from Tulare County, California, exposed to Omite-CR, a timed-release organosulfite miticide manufactured by Uniroyal. In addition to pesticide exposure, dermatitis may be related to crop contact, heat, preexisting atopic status, the presence of irritating weeds, or other factors. Organophosphate pesticide exposure can depress erythrocyte or plasma cholinesterase levels and can impair normal neurobehavioral function. Dibromochloropropane produces azoospermia among pesticide formulators.

The standardized mortality ratios (SMRs) of agricultural workers (farm supervisors, farmworkers, and nursery workers) aged 16 to 64 years who died between 1979 and 1981 were presented in the California Occupational Mortality study. The overall SMRs for white and black male agriculture workers was 166 and 250, respectively, both statistically significant. The causes of death contributing most to the overall risk among whites were falls and machinery accidents (SMR 380) and other accidents (SMR 310). Among black male agricultural workers, a similar SMR of 250 was reported for other accidents. These findings strongly suggest the need for improved safety designs for agricultural equipment and educational and intervention programs targeted at young male farm workers to lower the risks of accidental mortality.

In sum, new research and preventive programs are needed on cancer and pulmonary disease risks. Respiratory disease hazards are borne out by the significant risks for chronic obstructive pulmonary disease mortality among white and black male agricultural workers in the California Occupational Mortality Study report, with SMRs equaling 147 and 256, respectively. The occupational mortality study also reported that cirrhosis and other liver disease mortality was significantly elevated for white and black farmworkers (SMRs are 221 and 482, respectively), and the possible correlation with pesticide exposure should be examined. Pesticide exposures can be reduced by using integrated pest management methods, but given the current use patterns and regulatory climate, physicians will likely continue to see outbreaks of dermal and systemic poisonings such as the Omite-CR epidemic. New epidemiologic research combined with accident prevention programs is needed to preserve the health of agricultural workers.

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